<u>CLAIMS</u>

What is claimed is:

1. A method for designing a system, comprising:

generating minimum delay budgets for connections from short-path timing constraints;

5   and

designing the system in response to the minimum delay budgets.

2. The method of Claim 1, wherein generating the minimum delay budgets for the

connections, comprises finding a set of connection delays that attempt to satisfy the short-path

10   timing constraints.

3. The method of Claim 1, wherein generating the minimum delay budgets for

connections comprises allocating short-path slack.

15   4. The method of Claim 2, wherein finding the set of connection delays that attempt to

satisfy the short-path timing constraints comprises:

performing short-path timing analysis to determine short-path slack values; and

fixing any short-path timing constraint violations determined by the short-path timing

analysis.

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5. The method of Claim 4, wherein fixing any short-path violations comprises adding

delay in response to the short-path slack values and connection weightings.

6. The method of Claim 5, wherein the connection weightings is determined by a unit

25   weighting scheme.

7. The method of Claim 5, wherein the connection weighting is determined based on how much delay can be added before a practical limit is reached or all relevant violations are resolved.

5   8. The method of Claim 3, wherein allocating the short-path slack comprises:

performing short-path timing analysis to determine short-path slack values; and

allocating the short-path slack values determined by the short-path timing analysis.

9. The method of Claim 8, wherein allocating the short-path slack values comprises

10   subtracting delay from temporary delays in response to the short-path slack values and connection

weightings.

10. The method of Claim 9, wherein the connection weightings is determined by a unit weighting scheme.

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11. The method of Claim 9, wherein the connection weighting is determined based on how much delay can be subtracted before a practical limit is reached or all relevant slack is allocated.

20   12. The method of Claim 8, wherein minimum delay budgets are determined from the allocation of the short-path slack values.

13. The method of Claim 1, wherein generating the minimum delay budgets for connections respects lower and upper limits on connection delay.

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14. The method of Claim 1, wherein the minimum delay budgets are determined by starting with estimates of final connection delays.

15. The method of Claim 1, wherein generating the minimum delay budgets for connections comprises allocation of positive and negative slack using successive-over-relaxation.

16. The method of Claim 15, wherein allocation of positive and negative slack using successive-over-relaxationcomprises:

performing short-path timing analysis to determine short-path slack values; and

allocating the short-path slack values determined by the short-path timing analysis.

17. The method of Claim 16, wherein allocation of positive and negative slack using successive-over-relaxation occurs in response to the short-path slack values, connection weightings, and a multiplier indicating how much over-allocation should take place

18. A method for designing a system, comprising:

generating maximum delay budgets for connections from long-path timing constraints; and

designing the system in response to the maximum delay budgets.

19. The method of Claim 18, wherein generating the maximum delay budgets for connections comprises finding a set of connection delays that attempt to satisfy the long-path timing constraints.

20. The method of Claim 18, wherein generating the maximum delay budgets for connections comprises allocating long-path slack.

21. The method of Claim 18, wherein generating the maximum delay budgets for connections respects lower and upper limits on connection delay.

22. The method of Claim 18, wherein the maximum delay budgets are determined by starting with estimates of final connection delays.

23. The method of Claim 18, wherein generating the maximum delay budgets for connections comprises allocation of positive and negative slack using successive-over-relaxation.

24. The method of Claim 23, wherein allocation of positive and negative slack using successive-over-relaxation comprises:

performing long-path timing analysis to determine long-path slack values; and

allocating the long-path slack values determined by the long-path timing analysis.

25. The method of Claim 24, wherein allocation of positive and negative slack using successive-over-relaxation occurs in response to the long-path slack values, connection weightings, and a multiplier indicating how much over-allocation should take place.

26. A method for designing a system, comprising:

generating minimum and maximum delay budgets for connections from long-path and short-path timing constraints; and

designing the system in response to the minimum and maximum delay budgets.

27. The method of Claim 26, wherein generating the minimum and maximum delay budgets for connections comprises involves finding a set of connection delays that attempt to satisfy the short-path and long-path timing constraints.

28. The method of Claim 27, wherein generating the minimum and maximum delay budgets for connections comprises allocating short-path and long-path slack.

29. The method of Claim 27, wherein finding a set of connection delays that attempt to satisfy the short-path and long-path timing constraints comprises:

performing short-path timing analysis to determine short-path slack values;

fixing any short-path timing constraint violations determined by the short-path timing analysis;

performing long-path timing analysis to determine long-path slack values; and

fixing any long-path timing constraint violations determined by the long-path timing analysis.

30. The method of Claim 29, wherein fixing any short-path violations comprises adding delay in response to the short-path slack values and connection weightings.

31. The method of Claim 29, wherein fixing any long-path violations comprises subtracting delay in response to the long-path slack values and connection weightings.

32. The method of Claim 31, wherein the connection weightings is determined by a unit weighting scheme.

33. The method of Claim 31, wherein the connection weighting is determined based on how much delay can be subtracted before a practical limit is reached or all relevant violations are resolved.

34. The method of Claim 28, wherein allocating the long-path and short-path slack comprises:

performing long-path timing analysis to determine long-path slack values;

allocating the long-path slack values determined by the long-path timing analysis;

5   performing short-path timing analysis to determine short-path slack values; and

allocating the short-path slack values determined by the short-path timing analysis.

35. The method of Claim 34, wherein allocating the short-path slack values comprises subtracting delay from temporary delays in response to the short-path slack values and connection

10   weightings.

36. The method of Claim 34, wherein allocating the long-path slack values comprises adding delay to temporary delays in response to the long-path slack values and connection weightings.

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37. The method of Claim 36, wherein the connection weightings is determined by a unit weighting scheme.

38. The method of Claim 36, wherein the connection weighting is determined based on

20   how much delay can be added before a practical limit is reached or all relevant slack is allocated.

39. The method of Claim 34, wherein the maximum delay budgets are determined from the allocation of the long-path slack values.

25   40. The method of Claim 34, wherein the minimum delay budgets are determined from the allocation of the short-path slack values.

41. The method of Claim 34, wherein the algorithm iterates between performing short-path timing analysis and allocating short-path slack values; and performing long-path timing analysis and allocating long-path slack values; to re-determine minimum and maximum delay budgets, respectively.

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42. The method of Claim 26, wherein, for each connection, the maximum delay budget determined is greater or equal to the minimum delay budget determined for the respective connection.

10   43. The method of Claim 26, wherein, for each connection, the minimum and maximum delay budgets are determined such that each is determined with consideration of the other.

44. The method of Claim 26, wherein, the algorithm attempts to optimize some function

15 of the distance between minimum and maximum connection delay budgets.

45. The method of Claim 26, wherein designing the system in response to the maximum and minimum delay budgets comprises generating a synthesis strategy.

20   46. The method of Claim 26, wherein designing the system in response to the maximum and minimum delay budgets comprises generating a placement strategy.

47. The method of Claim 26, wherein designing the system in response to the maximum and minimum delay budgets comprises generating a routing strategy.

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48. The method of Claim 45, wherein generating the synthesis strategy comprises determining whether to add or remove levels of logic.

49. The method of Claim 45, wherein generating the synthesis strategy comprises determining whether to use slower or faster variants of a functional block.

50. The method of Claim 45, wherein generating the synthesis strategy comprises determining whether to use faster or slower logic structures.

51. The method of Claim 45, wherein generating the synthesis strategy comprises determining whether to use faster or slower logic inputs.

52. The method of Claim 45, wherein generating the synthesis strategy comprises determining whether dedicated routing resources should be used or avoided.

53. The method of Claim 46, wherein generating the placement strategy comprises determining how to place functional blocks so that dedicated routing resources are used or avoided.

54. The method of Claim 46, wherein generating the placement strategy comprises determining whether to place a first functional block closer or further apart from a second functional block.

55. The method of Claim 46, wherein generating the placement strategy comprises determining how to place two functional blocks to increase or decrease the routing delay between them.

56. The method of Claim 47, wherein generating the routing strategy comprises determining whether to use more or fewer routing resources.

57. The method of Claim 47, wherein generating the routing strategy comprises determining whether to use slower or faster routing resources.

58. The method of Claim 47, wherein generating the routing strategy comprises determining whether to use buffers to slow down or speed up routes.

59. A machine-readable medium having stored thereon sequences of instructions, the sequences of instructions including instructions which, when executed by a processor, causes the processor to perform:

generating minimum and maximum delay budgets for connections from long-path and short-path timing constraints; and

designing a system in response to the minimum and maximum delay budgets.

60. The machine-readable medium of Claim 59, wherein generating the minimum and maximum delay budgets for connections comprises finding a set of connection delays that attempt to satisfy the short-path and long-path timing constraints.

61. The machine-readable medium of Claim 59, wherein generating the minimum and maximum delay budgets for connections, in part, involves allocating short-path and long-path slack.

62. The machine-readable medium of Claim 60, wherein finding a set of connection delays that attempt to satisfy the short-path and long-path timing constraints comprises:

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performing short-path timing analysis to determine short-path slack values;

fixing any short-path timing constraint violations determined by the short-path timing analysis;

performing long-path timing analysis to determine long-path slack values; and

5   fixing any long-path timing constraint violations determined by the long-path timing analysis.

63. The machine-readable medium of Claim 62, wherein fixing any short-path violations comprises adding delay in response to the short-path slack values and connection weightings.

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64. The machine-readable medium of Claim 62, wherein fixing any long-path violations comprises subtracting delay in response to the long-path slack values and connection weightings.

65. The machine-readable medium of Claim 61, wherein allocating the long-path and

15   short-path slack comprises:

performing long-path timing analysis to determine long-path slack values;

allocating the long-path slack values determined by the long-path timing analysis;

performing short-path timing analysis to determine short-path slack values; and

allocating the short-path slack values determined by the short-path timing analysis.

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66. The machine-readable medium of Claim 65, wherein allocating the long-path slack values comprises adding delay to temporary delays in response to the long-path slack values and connection weightings.

67. The machine-readable medium of Claim 65, wherein allocating the short-path slack values comprises subtracting delay from temporary delays in response to the short-path slack values and connection weightings.

68. The method of Claim 13, wherein the lower and upper limits on connection delay are based on estimates of possible delays in the final system and/or values that improve the quality of the system being designed.

69. The method of Claim 21, wherein the lower and upper limits on connection delay are based on estimates of possible delays in the final system and/or values that improve the quality of the system being designed.

70. The method of Claim 26, wherein, for each connection, the maximum delay budget is determined with consideration of the minimum delay budget of the respective connection.

71. The method of Claim 26, wherein, for each connection, the minimum delay budget is determined with consideration of the maximum delay budget of the respective connection.

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